WHAT IS CLAIMED IS:

1. A thermally powered control assembly for a VAV diffuser comprising:

a damper member formed to be mounted across a supply air opening of the diffuser and formed for movement relative thereto to vary the volume of supply air discharged from the diffuser; and

a damper position control device including:

(i) not more than two thermal sensor-actuators, and

(ii) a movable linkage assembly operatively associated with the damper member and with the sensor-actuators to transmit movement of the sensor-actuators to the damper member for displacement of the damper member to vary the volume of supply air discharged from the diffuser in both a heating mode and a cooling mode, the movable linkage assembly being formed to produce changeovers to and from the heating mode and the cooling mode, the movable linkage assembly being formed to begin to move the damper member from a closed position in the heating mode at a heating set point temperature and to begin to move the damper member from a closed position in the cooling mode at a cooling set point temperature and, the linkage assembly being further formed for independent adjustment of the heating set point temperature and the cooling set point temperature.

2. The thermally powered control assembly as defined in claim 1 wherein,

the movable linkage assembly includes a lever mounted for pivoting about a selected one of two spaced apart pivot points; and

one of the two thermal sensor-actuators is a supply air temperature sensor-actuator adapted and positioned to produce pivoting of the lever about selected ones of the two pivot points depending upon the supply air temperature sensed in order to changeover to and from the heating mode and the cooling mode.

3. The thermally powered control assembly as defined in claim 2 wherein,

the supply air temperature sensor-actuator displaces a movable shoulder assembly into and out of engagement with pivot axles carried by the lever.

4. The thermally powered control assembly as defined in claim 3 wherein,

the shoulder assembly engages one axle on one side of the lever to pivot the lever about the engaged axle in one direction for heating mode and the shoulder assembly engages the other axle on an opposite side of the lever to pivot the lever about the engaged axle in the same direction for the cooling mode.

5. The thermally powered control assembly as defined in claim 1 wherein,

all of the movable linkage assembly and both sensor-actuators are positioned below, and are accessible from, a room side of the damper member.

6. The thermally powered control assembly as defined in claim 3 wherein,

all of the movable linkage assembly and at least one of the sensor-actuators are accessible upon removal of an appearance panel mounted transversely across the bottom side of the diffuser.

7. The thermally powered control assembly as defined in claim 1 wherein,

the movable linkage assembly is spring biased to urge the damper member toward a closed position.

8. The thermally powered control assembly as defined in claim 7 wherein,

the movable linkage assembly includes a pivoted lever and the lever is spring biased toward the closed position by an amount sufficient to support the weight of the damper member in the closed position against the pressure of the supply air.

9. The thermally powered control assembly as defined in claim 1 wherein,

the movable linkage assembly is gravity biased to allow the damper member to move toward an open position.

10. The thermally powered control assembly as defined in claim 1 wherein,

the movable linkage assembly is formed to prevent complete closing of the damper member in the closed position to provide a minimum flow of supply air from the diffuser in the closed position.

11. The thermally powered control assembly as defined in claim 10 wherein,

the movable linkage assembly includes a pivoted compound lever arm formed for adjustment of the position of the damper member in the closed position to vary the minimum flow of supply air from the diffuser in the closed position.

12. The thermally powered control assembly as defined in claim 11 wherein,

the compound lever arm is formed for adjustment of the angle of pivoting of the compound lever arm to adjust the position of the damper member in the closed position.

13. The thermally powered control assembly as defined in claim 12 wherein,

the compound lever arm includes an arm base member mounted for pivotal movement and driven by the sensor-actuators, a damper engaging arm member pivotally mounted to the arm base member, and a minimum flow adjustment member movably mounted for adjustment of the relative angle between the arm base member and the damper engaging arm member.

14. The thermally powered control assembly as defined in claim 13 wherein,

the compound lever arm includes at least one calibrated scale indicating the minimum flow produced by adjustment of the angle of the damper engaging arm member relative to the arm base member.

15. The thermally powered control assembly as defined in claim 14 wherein,

the compound lever arm includes a plurality of calibrated scales indicating the minimum flow produced by adjustment of the angle of the damper engaging arm member relative to the arm base member for a plurality of different supply air duct areas.

16. The thermally powered control assembly as defined in claim 2 wherein,

the other of the sensor-actuators is a room air temperature sensor-actuator which displaces the lever in a manner varying the position of the damper member as a function of the sensed room air temperature between:

(i) a closed position above the heating set point temperature in the heating mode and a fully open position; and

(ii) between a closed position below the cooling set point temperature in the cooling mode and a fully open position.

17. The thermally powered control assembly as defined in claim 1, and

an air flow directing structure including a room air induction channel positioned below the damper member and a supply air flow tube extending from an intake opening above the damper member to an outlet opening positioned for the discharge of supply air into the room air induction channel in a direction inducing the flow of room air along the room air induction channel; and

the plurality of thermal sensor-actuators are provided by a room air temperature sensor-actuator positioned for the flow of room air thereover and a supply air temperature sensor-actuator positioned below the damper member for the flow of supply air thereover.

18. The thermally powered VAV air diffuser assembly as defined in claim 17 wherein,

the room air temperature sensor-actuator is positioned in the room air induction channel upstream of discharge of supply air into the room air induction channel, and the supply air temperature sensor-actuator is positioned in the supply air flow tube below the damper member.

19. The thermally powered control assembly as defined in claim 17 wherein,

the outlet opening of the supply air flow tube is provided by a nozzle having an elongated outlet opening extending over substantially a full transverse dimension of the room air induction channel.

20. The thermally powered control assembly as defined in claim 19 wherein,

the elongated outlet opening is vertically elongated and extends over substantially the entire height dimension of the room air induction channel.

21. The thermally powered control assembly as defined in claim 17 wherein,

the damper member is movably mounted to the supply air flow tube.

22. The thermally powered control assembly as defined in claim 21 wherein,

the damper member is movably mounted to the supply air flow tube by a plurality of roller elements.

23. The thermally powered control assembly as defined in claim 1 wherein,

the damper member is mounted by roller elements to a vertically extending member of the damper position control device for vertical displacement therealong.

24. The thermally powered control assembly as defined in claim 23 wherein,

the vertically extending member is a supply air flow tube.

25. The thermally powered control assembly as defined in claim 1 wherein,

the movable linkage assembly includes a change over linkage formed to move the damper member to the closed position each time the damper position control device changes between the heating mode and the cooling mode.

26. The thermally powered control assembly as defined in claim 25 wherein,

the movable linkage assembly includes a pivotally mounted lever positioned to displace the damper member and pivoted by the thermal sensor-actuators; and

the change over linkage includes an over center linkage coupled to the sensor-actuators and to the lever and formed to displace the lever to a position closing the damper as the sensor-actuators move between the heating mode and the cooling mode.

27. The thermally powered control assembly as defined in claim 26 wherein,

the over center linkage includes a first link pivoted proximate one end to a support member and pivoted proximate the other end to an end of a second link, the first link being coupled intermediate the ends to a piston of the one of the sensor-actuators sensing supply air temperature, and the second link being pivotally coupled to the lever proximate other end of the second link.

28. The thermally powered control assembly as defined in claim 1 wherein,

the two thermal sensor-actuators are coupled together by a common piston used for both mod change-over

and room air temperature modulation of the position of the damper member.

29. A thermally powered VAV diffuser assembly comprising:

a diffuser housing formed for coupling to a supply air duct and formed for discharge of supply air therefrom;

a damper mounted across a supply air opening of the supply air duct and mounted for movement relative thereto to vary the volume of supply air discharged from the diffuser;

not more than two thermal sensor-actuators; and

a movable linkage assembly operatively associated with the damper and with the sensor-actuators to transmit movement of the sensor-actuators to the damper for displacement of the damper to vary the volume of supply air discharged from the diffuser in both a heating mode and a cooling mode, the movable linkage assembly being further formed to produce changeovers to and from the heating mode and the cooling mode as a result of changeovers of supply air temperature to and from warm air and cool air; and

the two thermal sensor-actuators and all of the movable linkage assembly being positioned below the damper.

30. The thermally powered diffuser as defined in claim 29 wherein,

the diffuser housing includes an appearance panel removably mounted to the housing; and

at least one of the sensor-actuators and the entire movable linkage assembly being accessible from a room

side of the diffuser upon removal of the appearance panel.

31. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly is formed to operatively associate the sensor-actuators with the damper member to move the damper member to a closed position in the heating mode at an adjustable heating set point temperature and to move the damper member to a closed position in the cooling mode at a cooling set point temperature which is adjustable independently of the heating set point temperature.

32. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly includes a lever mounted for pivoting about a selected one of two spaced apart pivot points; and

one of the two thermal sensor-actuators is a supply air temperature sensor-actuator adapted and positioned to produce pivoting of the lever about selected ones of the two pivot points depending upon the supply air temperature sensed in order to changeover to and from the heating mode and the cooling mode.

33. The thermally powered VAV diffuser as defined in claim 29 wherein,

an air flow directing structure including a room air induction channel positioned below the damper member and having an open side facing outwardly of the diffuser, and a supply air flow tube extending from an intake opening above the damper member to an outlet opening positioned for the discharge of supply air into the room

air induction channel in a direction inducing the flow of room air along the room air induction channel; and

the plurality of thermal sensor-actuators are provided by a room air temperature sensor-actuator positioned for the flow of room air thereover and a supply temperature air sensor-actuator positioned below the damper member for the flow of supply air thereover.

34. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly includes a pivoted compound arm formed for adjustment of the position of the damper member in the closed position to vary the minimum flow of supply air from the diffuser in the closed position.

35. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly includes a change over linkage formed to move the damper member to the closed position each time the damper position control device changes between the heating mode and the cooling mode.

36. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly is spring biased to move the damper member toward a closed position.

37. The thermally powered VAV diffuser as defined in claim 29 wherein,

the movable linkage assembly is gravity biased to move the damper member to an open position.

38. The thermally powered VAV diffuser as defined in claim 29 wherein,

the two thermal sensor actuators include a common piston coupled to both a change-over sensor-actuator and a room air temperature sensor-actuator.

39. A thermally powered control assembly for a VAV air diffuser comprising:

a movable damper member formed to extend across a supply air opening of the diffuser and movable relative thereto to vary the volume of supply air discharged from the opening; and

a damper position control device including a plurality of thermal sensor-actuators, and a movable linkage assembly operatively associated with the damper member and the sensor-actuators to transmit movement of the sensor-actuators to the damper member for displacement of the damper member to vary the volume of supply air discharged from the diffuser, all of the sensor-actuator elements and all of the movable linkage assembly being positioned on, and accessible from, a room side of the damper member while the diffuser is mounted in a supporting ceiling or wall.

40. The thermally powered control assembly as defined in claim 39, and

an air flow directing structure including a room air induction channel positioned below the damper member and a supply air flow channel extending from an intake opening above the damper member to an outlet opening positioned for the discharge of supply air into the room air induction channel in a direction inducing the flow of room air along the room air induction channel; and

the plurality of thermal sensor-activators are provided by a room air sensor-actuator positioned for the flow of room air thereover and a supply air sensor-actuator positioned below the damper member for the flow of supply air thereover.

41. The thermally powered control assembly as defined in claim 40 wherein,

the air induction channel is provided by an inverted U-shaped member having an open downwardly facing side;

the room air sensor-actuator is positioned in the room air induction channel upstream of discharge of supply air into the room air induction channel, and the supply air sensor-actuator is positioned in the supply air flow channel.

42. The thermally powered control assembly as defined in claim 41 wherein,

the movable linkage assembly is formed to produce a changeover between a heating mode and a cooling mode when supply air changes between warm air and cool air;

the movable linkage assembly is formed to produce modulation of the volume of supply air discharged from the diffuser in both the heating mode and the cooling mode based upon the room air temperature sensed by a room air sensor-actuator; and

the linkage assembly is formed to provide a heating set point temperature and a cooling set point temperature which are independently adjustable.

43. The thermally powered control assembly as defined in claim 40 wherein,

the movable linkage assembly includes a lever having a damper driving portion and a sensor-actuator driven

portion, the lever being mounted for pivoting about two spaced apart pivot points;

the thermal sensor-actuator assembly including a room air sensor-actuator mounted to engage the driven portion of the lever to pivot the lever about a selected one of the pivot points; and

the thermal sensor-actuator assembly including a supply air sensor-actuator mounted to displace the room air sensor-actuator to produce engagement of the driven portion of the lever for pivoting of the lever about one pivot point when cool supply air is sensed by the supply air sensor-actuator and for pivoting of the lever about the other pivot point when warm supply air is sensed by the supply air sensor-actuator.

44. A VAV air diffuser comprising:

a diffuser housing defining a supply air opening;

a damper member positioned in the housing and formed to extend across the supply air opening, the damper member being movably mounted by a plurality of roller elements for movement relative to the supply air opening to vary the volume of supply air discharged from the opening; and

a damper position control device including an actuator operatively associated with the damper member to transmit movement of the actuator to the damper member for rolling displacement of the damper member to vary the volume of supply air discharged from the diffuser.

45. The VAV air diffuser as defined in claim 44 wherein,

the actuator is provided by at least one thermal sensor-actuator and the damper member is mounted by the

roller elements to a vertically extending member in the housing.

46. The VAV air diffuser as defined in claim 45 wherein,

the vertically extending member is a supply air flow tube.

47. A thermally powered control assembly for a VAV air diffuser comprising:

a movable damper member formed to extend across a supply air opening of the diffuser and movable relative thereto to vary the volume of supply air discharged from the opening; and

a damper position control device including a plurality of thermal sensor-actuators, and a movable linkage assembly operatively associated with the damper member and the sensor-actuators to transmit movement of the sensor-actuators to the damper member for displacement of the damper member to vary the volume of supply air discharged from the diffuser, the damper linkage assembly including an adjustable minimum flow stop assembly causing the damper member to move to an adjustable closed position permitting discharge of supply air from the diffuser, the adjustable minimum flow stop assembly including a pivoted compound lever arm having a configuration which is adjustable from a room side of the damper member.

48. The thermally powered control assembly as defined in claim 47 wherein,

the compound lever arm is formed for adjustment of the angle of pivoting of the compound lever arm to adjust the position of the damper member in the closed position.

49. The thermally powered control assembly as defined in claim 48 wherein,

the compound lever arm includes an arm base member mounted for pivotal movement and driven by the sensor-actuators, a damper engaging arm member pivotally mounted to the arm base member, and a minimum flow adjustment member movably mounted for adjustment of the relative angle between the arm base member and the damper engaging arm member.

50. The thermally powered control assembly as defined in claim 49 wherein,

the compound lever arm includes at least one calibrated scale indicating the minimum flow produced by adjustment of the angle of the damper engaging arm member relative to the arm base member.

51. The thermally powered control assembly as defined in claim 50 wherein,

the compound lever arm includes a plurality of calibrated scales indicating the minimum flow produced by adjustment of the angle of the damper engaging arm member relative to the arm base member for a plurality of different supply air duct areas.

52. A thermally powered control assembly for a VAV air diffuser comprising:

a movable damper member formed to extend across a supply air opening of the diffuser and movable relative thereto to vary the volume of supply air discharged from the opening;

a damper position control device including a plurality of thermal sensor-actuators, and a movable linkage assembly operatively associated with the damper member and the sensor-actuators to transmit movement of the sensor-actuators to the damper member for displacement of the damper member to vary the volume of supply air discharged from the diffuser for both a heating mode of operation and a cooling mode of operation; and

the movable linkage assembly including a change over linkage formed to move the damper member to the closed position each time the damper position control device changes between the heating mode and the cooling mode.

53. The thermally powered control assembly as defined in claim 52 wherein,

the movable linkage assembly includes a pivotally mounted lever positioned to displace the damper member and pivoted by the thermal sensor-actuators; and

the change over linkage includes an over center linkage coupled to the sensor-actuators and to the lever and formed to displace the lever to a position closing the damper as the sensor-actuators move between the heating mode and the cooling mode.

54. The thermally powered control assembly as defined in claim 53 wherein,

the over center linkage include a first link pivoted proximate one end to a support member and pivoted proximate the other end to an end of a second link, the first link being coupled intermediate the ends to a piston of the one of the sensor-actuators sensing supply air temperature, and the second link being pivotally coupled to the lever proximate the other end of the second link.

55. A thermally powered control assembly for a VAV air diffuser comprising:

a movable damper member formed to extend across a supply air opening of the diffuser and movable relative thereto to vary the volume of supply air discharged from the opening; and

a damper position control device including a plurality of thermal sensor-actuators, and a movable linkage assembly operatively associated with the damper member and the sensor-actuators to transmit movement of the sensor-actuators to the damper member for displacement of the damper member to vary the volume of supply air discharged from the diffuser, the movable linkage assembly including a balancing arm formed to be selectively manually moved to a position dropping the damper member to a fully open position for balancing of a VAV system having the control assembly therein.

56. The thermally powered VAV diffuser as defined in claim 55 wherein,

the balancing arm is accessible for movement from an exterior of a VAV diffuser having the control assembly mounted therein.